

Are There Too Many Elk?



LESSON OVERVIEW

Students read an article that describes a data collection protocol used by wildlife managers. Then, using this information, they must analyze real data and make recommendations regarding the management of elk in Arizona.

SUGGESTED GRADE LEVELS

- 7 – 12

ENDURING UNDERSTANDINGS

- Decisions regarding the management of wildlife must use valid scientific data.

OBJECTIVES

Students will:

- Read and understand a scientific article.
- Analyze data to come to a conclusion.

ARIZONA DEPARTMENT OF EDUCATION STANDARDS

Grade	Science	Mathematics
7	S1-C3-01; S1-C3-05; S1-C4-03; S1-C4-05; S4-C3-04	S1-C2-10; S2-C1-07; S2-C1-08
8	S1-C3-01; S1-C4-03; S1-C4-05	S1-C2-09; S2-C1-08
High School	S1-C4-03; S1-C4-04; S3-C1-05; S3-C2-05	S2-C1-09; S2-C1-11

Note: The full text of these standards can be found in Appendix A.

TIME FRAME

- Two days (45 minutes each day)

MATERIALS

- *Forage Monitoring and Utilization* (one per student)
- *Forage Monitoring Comprehension Questions* (one per student)
- *Forage Monitoring Data* (one per group)

TEACHER PREPARATION

- Make copies of the *Forage Monitoring and Utilization* article and the *Comprehension Questions* for each student, and copies of *Forage Monitoring Data* for each group.
- Divide the class into groups of three to four students.



SUGGESTED PROCEDURES

1. Explain to students that the Arizona Game and Fish Department is responsible for managing Arizona's wildlife. As such, the department must sometimes prevent wildlife species from becoming overpopulated and causing harm to the environment. For game species (animals that are legally hunted), the department can reduce the size of their populations by recommending an increase in hunting opportunities. For nongame species, methods such as trapping and releasing animals into less populated areas can be used. Ask the students: how do you think wildlife managers monitor and "count" wildlife populations? Responses can be made in a journal or a class discussion.
2. Write some of the student responses on the board and discuss them.
3. Explain that these are all valid answers and are probably used in some way. Today, we are going to look at one method that the department uses to help make management decisions.
4. Hand out the *Forage Monitoring and Utilization* article and the *Forage Monitoring Comprehension Questions*. The students must read the article and answer the questions.
5. Give students time to work. If necessary, allow them to take the assignment home to finish.
6. When all students have completed the assignment, discuss their answers. It is important that the students have a good understanding of forage monitoring before moving on. *If you wish, your students can try forage monitoring for themselves. This requires a little more time and additional materials. See Appendix B for an explanation.*
7. Divide the class into their groups.
8. Explain that they will now have the opportunity to use their knowledge of forage monitoring to make recommendations regarding elk populations in eastern Arizona.
9. Hand out the *Forage Monitoring Data* form to each group. Instruct students to examine the data, make necessary calculations, and develop recommendations regarding the status of the populations in each Game Management Unit.
10. When all groups have finished, they must now present their findings to the rest of the class. Discuss their recommendations. Were there differences? If so, why would that be if all groups were using the same data?

ASSESSMENT

- Responses to *Forage Monitoring Comprehension Questions*
- Group presentations

EXTENSIONS

- Encourage students to research other methods that are used to manage animal populations. They may use the Internet or interview an expert in the field.



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Appendix A: Arizona Department of Education Standards – Full Text

Science Standards

Grade	Strand	Concept	Performance Objective
7	1	3 – Analysis and Conclusions	1 – Analyze data obtained in a scientific investigation to identify trends 5 – Formulate a conclusion based on data analysis
		4 – Communication	3 – Communicate the results of an investigation with appropriate use of qualitative and quantitative information 5 – Communicate the results and conclusion of the investigation
	4	3 – Populations of Organisms in an Ecosystem	4 – Evaluate data related to problems associated with population growth and the possible solutions
8	1	3 – Analysis and Conclusions	1 – Analyze data obtained in a scientific investigation to identify trends
		4 – Communication	3 – Present analyses and conclusions in clear, concise formats 5 – Communicate the results and conclusions of the investigation
High School	1	4 – Communication	3 – Communicate the results clearly and logically 4 – Support conclusions with logical scientific arguments
	3	1 – Changes in Environment	5 – Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity
		2 – Science and Technology in Society	5 – Evaluate methods used to manage natural resources (e.g., reintroduction of wildlife, fire ecology)

Mathematics Standards

Grade	Strand	Concept	Performance Objective
7	1	2 – Numerical Operations	10 – Calculate the percent of a given number
	2	1 – Data Analysis (Statistics)	7 – Interpret trends from displayed data 8 – Compare trends in data related to the same investigation
8	1	2 – Numerical Operations	9 – Calculate the missing value in a percentage problem
	2	1 – Data Analysis (Statistics)	8 – Compare trends in data related to the same investigation



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Mathematics Standards Continued

Grade	Strand	Concept	Performance Objective
High School	2	1 – Data Analysis (Statistics)	9 – Draw inferences from charts, tables, graphs, plots, or data sets 11 – Evaluate the reasonableness of conclusions drawn from data analysis



Appendix B: Forage Monitoring in the Field

Below are simplified procedures to give your students the opportunity to try forage monitoring firsthand.

Materials Needed

- Scissors, paper bag, a copy of the *Forage Monitoring Record* data sheet, and a 44-inch length of strong wire for each group
- A scale for weighing cuttings

Making the Plot Ring

This experiment requires the students to use a plot ring, which can be made by forming a loop out of a 44-inch length of strong wire. If done correctly, you will have a loop with an area of 0.96 square feet. If you do not use the correct size ring, the calculations will not be correct. Other materials, such as rope can be substituted for wire, but the circle will not be as accurate. You might want to have your students make their own rings by calculating the necessary size using the equations for the area and circumference of a circle:

$$\begin{aligned}\text{Area} &= \pi r^2 \\ \text{Circumference} &= 2\pi r\end{aligned}$$

Doing the Work

1. Take the students outside to the schoolyard or a nearby park.
2. Give a plot ring, a pair of scissors, and a paper bag to each group.
3. Each group must choose a separate location to place their ring. For best results, groups should choose areas that have different vegetative types.
4. Inform the groups that they are to use their scissors to cut away any plants growing within the circle and place the cuttings in the bag. To minimize damage, limit cuttings to green vegetation (leaves, grass, etc.).
5. Each group then weighs their cuttings on the scale, records the data, and completes the calculations on the *Forage Monitoring Record* sheet. Remind students that they need to subtract the weight of the bag to get accurate results.
6. The groups repeat these procedures for two more locations nearby and then average the results.
7. Display the results on the board so students can review the data that each group has collected. What conclusions can they draw?

Although students will not likely get results related to animal foraging, they may be able to compare the types of vegetation and their relative frequency in your region.

Going Beyond

It is possible to establish a long-term research project using this technique. Students choose a location near the school that has been disturbed by animals or people. Then, they place a fence around a small portion of this area. After a few months, they can compare cuttings from the fenced-in area to cuttings from outside the fence. Does this location appear to be overly used by animals or humans? If so, can they come up with ways to solve this problem?



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Appendix C: Worksheets and Overheads

The pages that follow contain the worksheets listed below:

- A. *Forage Monitoring and Utilization* – An article to introduce students to the process of forage monitoring (4 pages)
- B. *Forage Monitoring Comprehension Questions* – A way to determine if the students understood the reading (1 page)
- C. *Forage Monitoring Data* – Data collected from forage monitoring in Arizona that students can analyze (2 pages)
- D. *Forage Monitoring Record* – Data sheet to allow students to do forage monitoring (2 pages)

